Dec	h.	
2	9	Mercury in conjunction with and 3° 23′ south of the Moon.
3	17	Jupiter in conjunction with and 2° 38′ south of the Moon.
3	18	Mars at least distance from the Sun.
6	2	Venus in conjunction with and 2° 4′ south of the Moon.
6	22	Mars in conjunction with and 0° 15′ south of the Moon.
8	23	Jupiter in conjunction with the Sun.

Saturn, December 2.—Outer major axis of outer ring = 42″·8 : outer minor axis of outer ring = 10″·0 : southern surface visible.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·4	81 16 N.	Dec. 4,	23 46	*m*
Algol	3 0·9	40 31 N.	,, 4,	6 15	*m*
			,, 7,	3 4	*m*
λ Tauri	3 54·5	12 10 N.	,, 4,	18 29	*m*
R Canis Majoris	7 14·5	16 12 N.	,, 2,	23 33	*m*
			,, 4,	2 49	*m*
S Cancri	8 37·5	19 26 N.	,, 6,	22 13	*m*
W Virginis	13 20·3	2 48 S.	,, 2,	3 0	*m*
U Herculis	16 20·9	19 9 N.	,, 8,		*M*
W Herculis	16 31·3	37 34 N.	,, 4,		*M*
R Lyræ	18 51·9	43 48 N.	,, 3,		*M*
Y Cygni	20 47·6	34 14 N.	,, 4,	2 0	*m*
			,, 7,	1 54	*m*
δ Cephei	22 25·0	57 51 N.	,, 4,	6 0	*m*
			,, 5,	21 0	*M*

M signifies maximum ; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near η Persei	42°	56° N.	Very slow ; faint.
,, ζ Tauri	80	23 N.	Taurids II. Max. Dec. 6. Slow, brilliant.
,, δ Geminorum	110	24 N.	Rather swift.
,, β Ursæ Majoris	163	58 N.	Very swift ; streaks.

GEOGRAPHICAL NOTES.

AT the usual meeting of the Royal Geographical Society on Monday, Mr. J. Thomson read before a large audience a paper on "A Journey to the Atlas Mountains." He gave a most interesting account of the scenes visited, in the course of his trip, by himself and his companion, Mr. Harold Crichton-Browne. Describing some of the practical results, he said they had ascended and crossed the Atlas Chain in no fewer than six different places besides making various subsidiary trips into the lower ranges. A large series of barometric and boiling-point observations have been taken, which would assist in forming a more accurate idea of the general elevation of the range. Several glens had been explored, and the head-waters of some important streams had been mapped out. New and important light had been thrown upon the geological structure of the mountains. A small collection of plants from the higher altitudes had been made, and finally a series of photographs (which were exhibited) of the mountains, the inhabitants, and their houses have been obtained. He had reached an altitude in the mountains 1300 or 1500 feet higher than any other traveller.

THE December meeting of the Royal Geographical Society will be held on Monday, the 17th, at the University of London, instead of Monday, the 10th, as announced in the sessional programme. Colonel R. G. Woodthorpe will read a paper on explorations on the Chindwin River, Upper Burmah.

THE Russian Expedition for the exploration of Tibet, organized by the late General Prjevalsky, is, notwithstanding the death of the famous explorer, to be despatched on its mission. This announcement was made by M. Semenow, the Vice-President of the Russian Geographical Society, at a meeting held by the Society in honour of General Prjevalsky.

THE RENAISSANCE OF BRITISH MINERALOGY.[1]

AN ideal Presidential address should treat, not of a special point in the science of interest to a section only of the Society, but of the science in its broader aspects ; and the simplest permanent arrangement of this kind is that which makes it deal with the progress of the Society or of the science during the interval which has elapsed since the delivery of the next preceding address.

But in the case of our own Society we labour under special disadvantages, whether the address is to be on a specific subject or on the progress of the science. Not only is the Society small, but the number of its members able to devote any large part of their time to pure mineralogy is far smaller still. Hence if a set address were expected from the President we should be unnecessarily limited in our selection for that office. Many of our ablest members, men who would make the best of Presidents, men of wide culture and extensive general knowledge, men endowed with ideas and the power of expressing them, men who would bring to us a large experience obtained on the executive of other and larger Societies, though willing, nay anxious, to help us in the management of the affairs of the Society, would be prevented from giving us their services in the chair, owing to the sheer impossibility of devoting the requisite time and thought to the preparation of a purely mineralogical address such as they would consider worthy at once of the Society and of their own reputation.

Again, the number of our London meetings has been up to the present only three a year, and, as far as we can see, it is not yet desirable to increase their frequency. To set aside annually one-third, or even one-fourth, of the time of the Society for consideration of the views of the President, or of the progress and past work of the Society, would seem to be wanting in regard for proportion. A few minutes spent by the members in turning over the pages of the *Magazine* will give a better idea of the work of the Society, and be at the same time more exhilarating, than any summary a President can make. A report by the Council on the finance and general business, as brief as it can be made, seems to me sufficient for all reasonable purposes, and least wasteful of the time of the members and officers.

I have referred to the *Magazine*, and have said that a good idea of the work of the Society may be obtained in a few minutes by turning over the pages of one of its volumes. It may be cast in our teeth that the volume is small, but we can proudly and truly retort that few volumes of the same size furnish so vast an amount of heavy reading. The density, indeed, is prodigious—not that of lead, but of gold, refined gold. The volume is intended for transmission to all posterity, and not as a mere addition to the ephemeral literature and scientific gossip of a too prolific century. The present generation, by its careful use of the volume, will doubtless help it to reach its destination.

Bulky publications are, indeed, matters for shame rather than pride : they are the immediate ruin of a small Society, a perennial burden to librarians, and, as their contents are never completely indexed, a terror to subsequent investigators. The Ancients not unwisely refrained from the invention of printing ; they recognized that their duty to themselves was to read only what was worth the vast labour of transcription, and that their duty to posterity was to transmit to it only their masterpieces ; when even these became burdensome, an incendiary, doubtless a librarian, quickly reduced their volume. But for us Moderns the cost of multiplication of copies has become so small that everything, good or bad, is printed and preserved ; and it becomes necessary to spend the greater part of one's life in the preparation and study of indexes rather than of the literature itself. It would be an immense boon to mankind if some impartial and perfect tribunal could be empowered to do on the large scale what the curate and barber did so satisfactorily with Don Quixote's books on the small scale—distinguish the worthy from the worthless, and relentlessly annihilate that which ought not to cumber our shelves or demand even a passing glance.

I have said that the number of our members is small. I am not sure that it would be politic as yet to increase it. Members who have a living interest in mineralogy are most valuable, and of such we cannot have too many ; but mere subscribers of paltry gold would eventually be a source of weakness. After encouraging the Society to extravagant expenditure, they would fall away and leave it in the lurch.

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[1] Extracted from an address by Mr. Fletcher, the retiring President, at the annual meeting of the Mineralogical Society, October 30, 1888.

But is it necessary that the number of people in this country with a lively interest in mineralogy should remain so small? We have only to look abroad to see at once that the cause of this smallness of number is not inherent in the subject itself. In Germany, for instance, everyone—of course, with here and there a conspicuous exception—seems to be either a Professor of Mineralogy or a student of it. Periodical publications, at once voluminous and teeming with valuable results of scientific work, are there maintained. Somewhat more than a century ago, the study of minerals was everywhere popular, and received its share of attention from the cultured classes. Students thronged to Freiberg from all parts of the world to hang on Werner's lips.

There is one reason for this decline of general interest in mineralogy which I may mention in passing. In the good old days minerals were named and classified by help of simple external characters, and the facts of the science could be easily grasped without much preliminary training. Since then, the invention of crystallography and of the atomic theory, and the discoveries made in physical optics, have brought about a vast change in the treatment of the subject, and the mineralogy of to-day is even in its elements beyond the range of ordinary mortals. The pages of its text-books are sprinkled with wonderful formulæ designed by perverse chemists, and with unpronounceable hieroglyphics maliciously invented by cruel crystallographers.

But the chief reason for the decline of mineralogical study in our own country is that mineralogy has been almost completely excluded from our educational system. In the older Universities, it is true, mineralogy has been long represented by Professors, but, until lately at least, it has been allowed scarcely any weight in the examinations for a degree. The study of other branches of science has been encouraged, while that of mineralogy has been neglected and forgotten. One of the evils of the examination system is that all the available energy of our youth is concentrated wholly on subjects upon which stress is laid by a not omniscient Examining Board; most students, too, must almost necessarily take up subjects in which there is an opportunity of showing their comparative ability, and by a knowledge of which there is reasonable prospect of being able to gain a future livelihood.

Taught only as a subordinate and unimportant subject at the Universities, and not taught at all outside, pure mineralogy has been in great danger of becoming extinct in this country; a few years ago the capsizing of a coach or the bursting of a balloon might have been the end, and the British Professor or student of pure mineralogy have become a mere tradition.

The discovery of the transparency of thin rock-sections, and the important conclusions which may be arrived at from their microscopical examination, have now turned attention to mineralogy once more, and it seems likely that the knowledge of mineral characters requisite for petrographical work may at last lead to our mineralogical renaissance. Owing chiefly to the patience and perseverance of Prof. Lewis, there is now a certain amount of encouragement to mineralogical study at Cambridge; and if the renaissance is to be brought about, the example of Cambridge must be followed by the other Universities, and mineralogy be assigned a higher place in the examinational system.

Minerals are omnipresent. Is it unreasonable to ask that everyone should be taught their simple characters, and be shown how to recognize such minerals as are met with at every turn? The teaching would improve the capacity for observation, and give fresh interest to many a pleasant ramble—through the workings of a mine. And is not Prof. Ruskin in the right when he claims that a knowledge of the minerals, conveniently grouped as precious and ornamental, should form a part of every gentle education? More especially ought we not to insist upon such elementary teaching for the numerous officials sent out by the nation to the less explored regions of the world?

In the higher teaching of mineralogy, difficulties present themselves, but they might easily be lessened by division of labour; a preliminary training in the elements of mathematics, physics, chemistry, and crystallography being absolutely necessary to the manufacture of a mineralogist. The teaching of crystallography is generally relegated to the Professor of Mineralogy, and the subject regarded as a mineralogical difficulty; but this ought not to be the case. It is true that a mineralogist was the first to discover a relationship between the various crystallized forms of the same substance, and thus to institute a crystallographic science, which has since been found indispensable in mineralogical study. It is true that the mineralogist has been the originator of every advance in crystallographic knowledge. It is true that the mineralogist has in minerals ready-made crystallizations, which in their excellence and variety of form can rarely be imitated in the laboratory. But it is no more the province of a mineralogist to teach crystallography than it is to teach chemistry or the use of a delicate balance. He does teach it indeed, but that is merely because his pupils reach him imperfectly trained for the pursuance of his own subject.

Crystallography should be taught as a special subject; and a knowledge of it should be required not only of the mineralogist but of the chemist, and even of the physicist. Hitherto, at least, the chemists of this country have been too content either to leave the crystalline forms of their artificial products undetermined, or to impose the task of their determination on the already sufficiently occupied mineralogist. It seems obvious that in a satisfactory system of education every chemist should be taught how to measure and describe the crystalline characters of the products which it is his fate to call into existence. On various occasions expression has been given to this view, but the only chemist who has yet seen his way to act upon it is Prof. Henry Armstrong, who, I am happy to say, has introduced the subject into the educational course of the City and Guilds Technical Institute. I trust that before another generation passes away his excellent example will be followed throughout the country. A knowledge of the elements of crystallography, including the mechanics of crystal measurement, ought to be made a *sine quâ non* for a degree in chemistry at every University.

The measurement of the angles of a crystal, the determination of its symmetry, and the calculation of its form, are infinitely less difficult than is generally imagined: given a knowledge of elementary mathematics and the careful use of measuring instruments, the processes are in general extremely simple. The complexity of crystallographic calculation is only apparent, and is due to the existence of text-books: they are generally worse than useless. A voluminous work on crystal-calculation is usually an attempt to provide formulæ which shall enable a student to solve every possible problem by rule of thumb, without his needing to have the faintest idea of what he is really doing. Practically, anyone familiar with the processes of trigonometry can deduce from first principles the formula required for each special case as it occurs in less time than he can discover the rule in the ponderous tome invented for his mystification.

I am, of course, far from asserting that the teaching of crystallography presents no difficulties at all: what I do wish to insist upon is that the kind of crystallographic knowledge requisite for the chemist in his own work is such that it may fairly be demanded of every one of them: the higher flights may be abandoned to the specialist.

At the present time, when Professors of Crystallography are not yet called into existence, there is one step which ought to be at once taken, and which would make mineralogy more possible eventually to a large number of our students. Every student of practical physics is taught how to measure with a reflecting goniometer the angles of an artificial prism: he should further be taught the measurement of the angles of a simple crystal, and the deduction of its symmetry. In his optical studies especially, such a practical knowledge of crystalline symmetry would be a great help to him. The reflecting goniometer in one of the forms used for crystallographic work might well be an instrument in use in every physical laboratory, and would subserve many a useful purpose. As soon as every physicist is taught how to determine the angles and symmetry of a simple crystal, and every chemist is further enabled to define the crystalline forms of his artificial products, we shall have a large army of students for whom the transition to mineralogical work will be easy; then, and not till then, can we hope for any useful increase in the number of the members of this Society; then, and not till then, can we hope that our country will in its study of mineralogy take its proper place among the nations of the earth.

One more point I may mention. Until a few years ago there were two distinct Societies, a Mineralogical and Crystallological: they had objects far from identical, and in a more perfect world might have flourished side by side. The fusion of the two Societies without any extension of the title of the Mineralogical has had for its effect that we cannot satisfactorily demand what the Crystallological could—namely, the support of the organic chemist; and although it was understood at the time of the fusion that papers on the crystallization of artificial products, organic or inorganic, should be within the scope of the joint Society, their inclusion in a *Mineralogical Magazine* would suggest a misnomer. The change or extension of our already lengthy title has its evident inconveniences, but it may be worthy of careful deliberation by the Society at some early date as to whether such an extension is not really necessary for the clearer definition of our objects if we are to enlist the sympathy of many who, though they may feel to be beyond the pale of a Mineralogical Society, yet by their investigation of the crystalline forms of the products of the laboratory may in the future, as in the past, throw light on the crystallography of the Mineral Kingdom.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The following gentlemen have been appointed examiners:—

Mathematical Tripos, Part II.: Dr. Routh (Chairman), Messrs. W. Burnside, J. Larmor, and A. R. Forsyth.

Natural Sciences Tripos and 2nd M.B.: Dr. Hill (Master of Downing), Prof. Cleland (Human Anatomy), Prof. Stirling, Dr. Gaskell (Physiology).

Natural Sciences Tripos: Prof. W. G. Adams, Mr. W. N. Shaw (Physics), Prof. W. A. Tilden, Mr. H. J. H. Fenton (Chemistry), Prof. Lewis, Prof. Story-Maskelyne (Mineralogy), Mr. F. Darwin, Prof. H. Marshall Ward (Botany), Mr. W. F. R. Weldon, Mr. F. S. Harmer (Zoology).

Natural Science Tripos and Special B.A.: Mr. W. W. Watts, Mr. A. Harker (Geology).

M.B. and Special B.A.: Prof. W. G. Adams, Mr. S. L. Hart (Elementary Physics), Mr. H. F. Neville and Mr. H. J. H. Fenton (Elementary Chemistry), Mr. F. Darwin and Mr. S. F. Harmer (Elementary Biology).

2nd M.B. only: Mr. Pattison Muir and Mr. H. Robinson (Pharmaceutical Chemistry).

Messrs. W. Carruthers, F.R.S., and J. E. Marr are appointed examiners for the Sedgwick Prize to be adjudged in 1892.

The University Lectureships in Botany and Advanced Human Anatomy, tenable for five years, are vacant. Candidates must send their names to the Vice-Chancellor on or before November 30.

Open Scholarships and Exhibitions will be competed for at the following Colleges, beginning on the undermentioned dates: Mathematics, Pembroke, December 11; Trinity Hall, December 11; Queens', December 12; Mathematics and Natural Science, Gonville and Caius, December 7; King's, December 10; Jesus, Christ's, and Emmanuel combined, December 11; St. John's, December 11; Trinity, December 11; Sidney Sussex, January 1. The tutors will give full information.

The Sheepshanks' Astronomical Exhibition will be competed for on December 10 and 11 at Trinity College.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 15.—"Combustion in Dried Oxygen." By H. Brereton Baker, Dulwich College, late Scholar of Balliol College, Oxford. Communicated by Prof. H. B. Dixon, F.R.S.

In 1884, some preliminary experiments, published in the Journal of the Chemical Society, convinced me that moisture exerted an important influence on the combustion of carbon. Since that time experiments have been made, not only with that element but with several others, and the same influence seems to be exerted on the combustion of some, while no such influence could be detected in the case of other elements. It was discovered very early in the investigation that hydrogen, both free and combined, aided the union of carbon with dried oxygen, and therefore, for the new experiments on this and other elements, special attention was devoted to their purification from hydrogen. It was found that two of these elements, amorphous phosphorus and boron, had, like carbon, a very great power of occluding hydrogen. To eliminate it some of the elements were heated in a current of pure chlorine, while others were heated in sealed tubes with the chlorides of the elements, special precautions being taken to free the purified elements from all traces of the agents used in their purification. In this way the elements—carbon, sulphur, boron, and phosphorus, the latter in both red and yellow modifications—were found to have their combustion influenced by the dryness of the oxygen. Some chemical union was found to take place, the extent of which varied with the dryness of the substances. In no case, however, did it manifest itself by flame. Ordinary phosphorus was obtained so pure as not to glow in the oxygen dried by phosphorus pentoxide, though the pressure was increased and diminished in every possible way. If water was added, rapid combustion at once set in.

The elements—selenium, tellurium, arsenic, and antimony—were purified with as much care as was expended on the elements mentioned above. Their combustion was, however, not found to be affected in any way by the dryness of the gas.

In the course of the investigation two facts were discovered about the combustion (1) of amorphous phosphorus, and (2) of carbon in oxygen. Amorphous phosphorus is generally regarded as being incapable of true combustion. It is asserted that before amorphous phosphorus can be heated to its kindling point, it changes into ordinary phosphorus, which then burns. This has been proved not to be the case. Amorphous phosphorus was heated in a current of nitrogen, free from traces of oxygen, to 260°, 278°, and 300° in three experiments, without undergoing any change to the ordinary modification. If moist oxygen was substituted for the nitrogen, combustion took place at 260°. It seems, therefore, probable that amorphous phosphorus undergoes a true combustion in oxygen without previous change to the ordinary modification.

With regard to the combustion of carbon, it has always been a doubtful question which of the two oxides is first formed. Is carbon monoxide the first product, undergoing further oxidation to the dioxide, or is carbon dioxide the first and only substance formed? The problem seems incapable of direct solution. It is, however, open to indirect attack. When carbon is heated in a current of partially dried oxygen, a slow combustion goes on, and, though the oxygen is in excess, both oxides are produced. The amount of monoxide, however, is twenty times the amount of the dioxide. Experiments also show that this occurs at temperatures at which dry carbon dioxide is not reduced by carbon. The carbon monoxide must, therefore, be produced by the direct union of its elements, its further oxidation being prevented by the dryness of the gases. Confirmatory experiments were performed in which carbon monoxide was found to be produced by the slow combustion of carbon in air at 440°, a temperature too low for the reduction of the dioxide by carbon. It is probable that the ordinary combustion of carbon goes on in two stages, that carbon monoxide is first produced, and, if circumstances are favourable, this is further oxidized to carbon dioxide.

"On the Secretion of Saliva, chiefly on the Secretion of Salts in it." By J. N. Langley, M.A., F.R.S., Fellow of Trinity College, and H. M. Fletcher, B.A., Trinity College, Cambridge.

Heidenhain has shown that when saliva is obtained by stimulating the chorda tympani, the percentage of salts in the saliva depends upon the rate of secretion, so that the faster the secretion the higher the percentage of salts is up to a limit of about 0·6 per cent.

The authors do not find any rate of secretion beyond which an increase in rate fails to increase the percentage of salts in the saliva. The increment in the percentage of salts decreases, however, with each equal successive increment in the rate of secretion.

As a rule, in saliva obtained by injecting pilocarpine, the percentage of salts follows Heidenhain's law; the exceptions are probably due to the action of pilocarpine upon the circulation.

The percentage of salts in saliva obtained by stimulating the sympathetic is higher than corresponds to its rate of secretion, the saliva obtained by stimulating the chorda being taken as a basis of comparison; this sympathetic saliva may be secreted at $\frac{1}{180}$th of the rate of chorda saliva, and yet contain very nearly as high a percentage of salts.

Dyspnœa decreases the rate of secretion of saliva with a given stimulus, and if not too prolonged, increases the percentage of salts, and tends to increase the percentage of organic substance in the saliva.

Clamping the carotid during secretion has the same general effect as dyspnœa, but it causes a still more marked increase in the percentage of salts. Its after-effect is also much greater, and lasts longer.